

ACCESSION #: 9910200027

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Diablo Canyon Unit 1 PAGE: 1 OF 6

DOCKET NUMBER: 05000275

TITLE: Reactor Trip Due to Lightning Strike

EVENT DATE: 09/22/1999 LER #: 1999-006-00 REPORT DATE: 10/15/1999

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Roger Russell-Senior Regulatory

Services Engineer TELEPHONE: (805) 545-4327

COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:

REPORTABLE EPIX:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On September 22, 1999, at 0932 PDT, with Unit 1 in Mode 1 (Power Operation) at 100 percent power, the unit experienced a full load rejection after the 500 kV supply breakers opened. Approximately 9 seconds later, the reactor tripped automatically. Unit 1 was stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. During the transient, two power operated relief valves opened for less than 1 second each. A 4-hour non-emergency report was made to the NRC at 1150 PDT in accordance with 10 CFR 50.72 (b)(2)(ii).

The full load rejection was caused by a lightning strike which actuated a 500 kV overvoltage relay and opened the 500 kV breakers for Unit 1. The reactor trip was initiated by a valid OT delta T signal.

Walkdowns of the affected areas were completed with no equipment damage indicated. PG&E is evaluating the design of the lightning protection system and the relay protection scheme for enhancements.

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I. Plant Conditions

Unit 1 was operating in Mode 1 (Power Operation) at 100 percent power at the time of the event.

II. Description of Problem

A. Summary

On September 22, 1999, at 0932 PDT, with Unit 1 in Mode 1 at 100 percent power, the unit experienced a full load rejection after the 500 kV supply breakers (EL)(BRK) opened. Approximately 9 seconds later, the reactor (AA)(RCT) tripped automatically. Unit 1 was stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. During the transient, two power operated relief valves (PORVs)(AB)(RV) opened for less than 1 second each. A 4-hour non-emergency report was made to the NRC at 1150 PDT in accordance with 10 CFR 50.72 (b)(2)(ii).

B. Background

An AC overvoltage 500 kV line relay protects the plant from overvoltage conditions on the 500 kV transmission system. The relay was designed with two settings - instantaneous at 150 V control voltage equivalent to 650 kV

phase to phase and 140 V control voltage equivalent to 606 kV with a time delay relay. The function of the relay is overvoltage, not lightning protection. When actuated, the relay trips the 500 kV breakers, but does not initiate a unit trip. This design allows the unit to attempt recovery from a full load rejection.

The lightning arrestors are designed to protect the high voltage winding of the main and startup transformers against impulse and switching surges on the transmission line. Each lightning arrestor is mounted on its own separate structure near the transformers they protect. The ratings of the 500 kV lightning arrestors are as follows: maximum continuous overvoltage of 335 kV rms phase to ground or 580 kV rms phase to phase. In addition, the lightning arrestor has a 1 second temporary overvoltage of 463 kV rms phase to ground, or 802 kV phase to phase.

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C. Event Description

On September 22, 1999, at 0932 PDT lightning struck the static ground wire protecting the Unit 1 500 kV tie line from the plant to the 500 kV switchyard. The strike elevated the ground potential and actuated the 500 kV overvoltage relay which opened the 500 kV breakers for Unit 1. Opening the breakers caused a full load rejection.

The Unit 1 main generator continued to operate for 9 seconds, initially increasing, then decreasing speed, and lost synchronism with the PG&E system. When the reactor tripped, the synchronism-check relays on the 12

kV buses prohibited fast transfer, as designed. During the backup slow transfer of the 12 kV buses, the voltage decay time slowed the reactor coolant pumps and caused reactor low flow alarms. When the slow transfer was completed, reactor coolant pumps were reenergized and RCS flow returned to normal.

Approximately 6 six seconds after the lightning strike, PORVs 474 and 456 opened, as designed. Both valves reseated in less than 1 second.

Approximately 3 seconds later, the reactor tripped on a valid OT delta T signal. Reactor coolant system (RCS) temperature and pressure increased immediately as a result of the load rejection. During the first 6 seconds of the transient, the OT delta T setpoint increased from 120 to 126 percent. When two of the three PORVs opened, RCS pressure dropped rapidly. The decreasing pressure with increasing temperature decreased the OT delta T setpoint rapidly and tripped the reactor.

Licensed operators in the control room responded in accordance with established emergency procedures, confirmed the reactor trip, verified proper engineered safety features (ESIF) actuations, and initiated manual actions to stabilize the unit in Mode 3.

On September 22, 1999, at 1150 PDT, a 4-hour non-emergency report was made to the NRC in accordance with 10 CFR 50.72 (b)(2)(ii).

D. Inoperable Structures, Components, or Systems that Contributed to the Event

None.

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E. Dates and Approximate Times for Major Occurrences

1. September 22, 1999, at 0932 PDT: Event date: A Unit 1 trip was initiated due to a lightning strike.
2. September 22, 1999, at 0932 PDT: Two PORVs lifted and reseated.
3. September 22, 1999, at 1150 PDT: A 4-hour non-emergency report was made to the NRC in accordance with 10 CFR 50.72(b)(2)(ii).

F. Other Systems or Secondary Functions Affected

None.

G. Method of Discovery

The event was immediately apparent to the operators due to alarms and indications received in the control room.

H. Operator Actions

Licensed operators in the control room responded in accordance with established emergency procedures, confirmed the reactor trip, verified proper ESF actuations, and initiated manual actions to stabilize the unit in Mode 3.

I. Safety System Responses

1. The reactor trip breakers opened.

2. The main turbine tripped (turbine stop valves closed).
3. The control rod drive mechanism allowed the control rods to drop into the core.

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4. The motor-driven auxiliary feedwater (AFW) pumps and the turbine driven AFW pump started automatically and delivered water to all steam generators as required.
5. Containment Fan Cooler Units, CFCU -1-1, 1-2, 1-3, 1-4, and 1-5 started in slow speed as required.
6. The diesel generators did not start, per design.
7. The 12 kV buses slow transferred to offsite power.
8. The 4 kV safety buses automatically transferred to startup power.
9. Auxiliary saltwater and component cooling water pumps restarted after the 4 kV buses were reenergized.

III. Cause of the Problem

A. Immediate Cause

The reactor tripped due a valid OT delta T signal.

B. Root Cause

The trip was caused by a lightning strike which actuated the overvoltage protection relay and opened the Unit 1 500 kV breakers causing a full load rejection.

IV. Analysis of the Event

A reactor trip from 100 percent power is a previously analyzed Final

Safety Analysis Report Update, Chapter 15, Condition 11 event. The reactor trip was initiated by an OT delta T signal as designed. The unit was stabilized in Mode 3 in accordance with approved plant procedures.

After review of reactor trip data, PG&E determined that the plant response was correct. Thus, the health and safety of the public were not affected by this event.

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The event was not evaluated using the criteria defined in the NRC's Significance Determination Process because reactor scrams are accounted for in the performance indicator program.

V. Corrective Actions

A. Immediate Corrective Actions

Walkdowns were performed on the line between DCPD and the 500 kV switchyard. The 500 kV switchyard was also inspected. In addition, the main bank transformers, lightning arrestors, coupling capacitor voltage transformers, and auxiliary transformers were inspected. No abnormalities were identified. The counter on the lightning arrestor had not actuated.

The 500 kV overvoltage relay was calibrated to assure it was functional. The relay was found within calibration limits. It was returned to service with the instantaneous overvoltage unit disabled, leaving the time delay overvoltage unit active. Since a true line

overvoltage condition was not detected, PG&E believes the instantaneous unit actuated from lightning caused ground potential changes. Further evaluation concluded that the time delay unit is sufficient to provide system overvoltage protection for the main bank transformers.

B. Corrective Actions to Prevent Recurrence

PG&E is evaluating the design of the lightning protection system for enhancements. Results of the evaluation will be reviewed and changes implemented, if warranted.

PG&E is also evaluating the relay protection scheme. Results of the evaluation will be reviewed and changes implemented, if warranted.

VI. Additional Information

A. Failed Components

None.

B. Previous Similar Events

None.

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Pacific Gas and

Electric Company David H. Oatley Diablo Canyon Power Plant

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PG&E Letter DCL-99-118

U.S. Nuclear Regulatory Commission

ATTN: Document Control Desk

Washington, DC 20555-0001

Docket No. 50-275, OL-DPR-80

Diablo Canyon Unit 1

Licensee Event Report 1-1999-006-00

Reactor Trip Due to Lightning Strike

Dear Commissioners and Staff:

Pursuant 10 CFR 50.73(a)(2)(iv), PG&E is submitting the enclosed licensee event report regarding a reactor trip due to a lightning strike.

This event did not adversely affect the health and safety of the public.

Sincerely,

David H. Oatley

cc: Steven D. Bloom

Ellis W. Merschoff

David L. Proulx

Diablo Distribution

INPO

Enclosure

TLH/2246/N0002104

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